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Contents for May, 1936

	PAGE
A Fluorescent Ink. By R. C. Hoover	Bulletin Board
A Unique Fluorescent Experiment. By L. J. Hauser.....	Bulletin Board
The Fluorescent and Phosphorescent Minerals of Bedford, N. Y. By Peter Zodac	65
Collecting Minerals at Night. By Oscar R. Smith	66
Fluorescence in Herkimer Quartz Crystals. By Alan W. Bernheimer	67
How to Use Fluorescent Minerals for Decorative Effects By L. J. Hauser	67
Some Observations on Fluorescence and Phosphorescence. By Peter Zodac	68
Fourth National Outing of the Rocks and Minerals Association ...	72
Some Notes on Fluorescence. By L. J. Hauser	73
The Importance of Fluorescence and Phosphorescence. By Peter Zodac	74
Some Interesting Phosphorescent Minerals. By Peter Zodac.....	75
Autunite in Mitchell County, North Carolina. By Bradley Johnson	76
The Amateur Lapidary. Conducted by J. H. Howard	78
The Ancient Lapidary. By J. H. Howard	78

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ROCKS and MINERALS

PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

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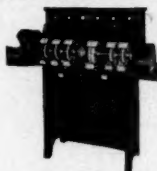
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ROCKS and MINERALS

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WHOLE NO 59

THE FLUORESCENT AND PHOSPHORESCENT MINERALS OF BEDFORD, N. Y. By PETER ZODAC *Editor ROCKS and MINERALS*

The most important mineral locality in New York is Bedford, a little village in the eastern part of Westchester County, not far from the Connecticut border. Wide and varied are the minerals found in its feldspar quarries. Some of them occur as beautiful gemmy crystals which can be cut into gems; others grade down into rough, irregular masses that are interesting only because of their rarity.

One class of minerals eagerly sought for are those which fluoresce, of which autunite and hyalite are the most important. Both fluoresce green, but hyalite is the better of the two as it occurs in larger sizes, and its fluorescence is brighter. In both cases they are of secondary origin and coat other minerals, especially microcline and morion. Under the argon bulb, they fluoresce easily (and are the only ones to do so) but under the cold-quartz lamp they are especially active and reach their best development. In addition, gummite, uranophane, beryl, rose quartz and limonite also fluoresce while albite, hyalite and microcline phosphoresce.

Autunite occurs as tiny lemon-yellow scales, scattered over other minerals; often they are small in quantity and very inconspicuous so that they may easily escape detection. The microcline which is especially prolific for autunite and hyalite, is a dark pinkish to brownish variety (altered or stained) of feldspar. It is usually accom-

panied by muscovite (which generally is stained brownish by limonite), and the deep black variety of smoky quartz known as morion. Small black crystals of columbite are usually present, imbedded chiefly in the muscovite or along the contact of muscovite and other minerals. Dark brown crystals of garnet may also be present. Seldom are these microcline specimens attractive but under the ultra violet rays, and especially if they are heavily encrusted by a fluorescent mineral, they are beautiful.

Hyalite is the best of the fluorescent minerals to occur at Bedford. It fluoresces a bright green. It occurs as greenish glassy botryoidal crusts, of minute thinness and generally in small patches. The mineral has been deposited along cracks and joints of quartz, feldspar or other minerals and generally in small depressions which due to its clearness may often escape detection, especially if present in small amounts. It would seem that hyalite, when in a liquid state, flowed through the rocks and was deposited only in depressions — evidently the solution was not deep enough to reach the tops of the little elevations in the joints or cracks. This presupposes that all joints and cracks containing hyalite were lying horizontally or nearly so in the rocks.

It was supposed that hyalite at the Bedford quarries always occurred in a greenish color but—a colorless va-

riety also is present. One night the writer, in testing a lot of Bedford minerals for fluorescence, noticed that the termination of a large beryl crystal fluoresced a bright green. As the fluorescence appeared in large spots, it was believed that large scales of autunite coated the crystal. Next day the crystal was examined but the fluorescent mineral could not be discovered. Again that night the mineral was exposed to the lamp, and again the fluorescence was noted. This time the crystal face was marked and next day carefully examined when it was found that minutely thin colorless patches of hyalite coated tiny depressions on the crystal face. This was the first instance of colorless hyalite, known to the writer, to occur at the Bedford quarries; the crystal came from the Baylis quarry and since then a few other specimens were found.

Gummite is an orange, waxy mineral (resembling gum) which is an alteration product of uraninite. Generally gummite occurs as a thin encircling orange ring about a small black mass of uraninite. Under the cold-quartz lamp, gummite fluoresces a light green.

Uranophane is a deep yellow alteration product of gummite. It occurs generally in two forms; either as a yellowish ring around gummite or as small rounded masses in tiny pits in feldspar (in the latter case it has completely replaced gummite). Like gummite, uranophane fluoresces a light green under the cold-quartz lamp.

Beryl is very common at the quarries ranging in size from tiny crystals up to large ones weighing hundreds of pounds, and in two colors, green and brown. Under the cold-quartz lamp the brown variety assumes a deep-green color. The green also fluoresces—a light green.

Rose Quartz is another very common mineral and occurs only in massive form. It varies in color from pale to

deep rose. Under the cold-quartz lamp it becomes pale-purple in color.

Limonite likewise is very common and occurs chiefly as brown to yellow stains on other minerals. Under the cold-quartz lamp, limonite becomes a light green.

Phosphorescence

Three minerals from the quarries phosphoresce nicely under the cold-quartz lamp. The brightest is **albite** and especially the stained type, which becomes golden-brown after a few seconds exposure. Even the chalky-white variety from the Kinkel quarry, where it is especially plentiful, (the white surface is due to alteration to kaolin), phosphoresces slightly.

Microcline, and especially the altered variety associated with columbite, autunite and hyalite, phosphoresces a pale golden brown. It was at first thought that cyrtolite also phosphoresced but on further examination it was found that its matrix, believed to be microcline, was the phosphorescent mineral.

Hyalite, as a colorless crust, in small patches, on massive smoky quartz, phosphoresces a greenish-blue. Two specimens were found and they are the only hyalites from Bedford, known to the writer to phosphoresce, and the only ones further known not to fluoresce. The specimens were collected at the small quarry adjacent to the Colgate quarry on the south.

The writer has collected and examined many thousands of specimens from the ten quarries in and around Bedford in preparation for an article on "Minerals of the Bedford Quarries" which is to appear in a future issue of **ROCKS and MINERALS**. Unfortunately, in the preparation of this article, only a few specimens, a hundred or so, could be examined under the cold-quartz lamp. It is possible, therefore, that other minerals found at Bedford may fluoresce or phosphoresce and may even surpass those described in this article.

Collecting Minerals at Night

Impossible! you say. Not if you are looking for fluorescent material. Simply remove the glass from your flashlight and in any suitable manner attach

your favorite UV filter glass. Be sure to leave the reflector in place. Very simple; most portable—and it works surprisingly well.

OSCAR R. SMITH.

FLUORESCENCE IN HERKIMER

QUARTZ CRYSTALS . . By ALAN W. BERNHEIMER

The article in the April issue of *ROCKS and MINERALS* by Mr. Paul Zimmer entitled "Notes On the Separation of Two Rock Crystals" brought to mind a rather unusual case of fluorescence in the well known "Herkimer diamonds."

Quartz crystals collected at different places in Herkimer County, New York, in 1930, and subsequently examined under the light of an argon bulb, were found to contain small inclusions which fluoresced a bright greenish-blue. The largest of these greenish-blue inclusions was 2 mm. in diameter.

The inclusions were studied under the low power of a binocular microscope with both ultra-violet and visible light. They were found to be associated with bubbles of gas. In typical cases, the gas bubble is surrounded by a liquid, and both of these are inclosed in a cavity in the crystal. It is the liquid which surrounds the gas bubble that fluoresces.

Of 231 crystals examined, 22 or about ten per cent possessed fluorescent inclusions. They were found in crystals of all sizes, but most frequently in those bearing considerable amounts of carbon.

HOW TO USE FLUORESCENT MINERALS

FOR DECORATIVE EFFECTS . . By L. J. HAUSER

The fluorescent mineral collector who may like to experiment with his specimens, may obtain some good effects by grinding some of his duplicates as fine as possible, without destroying their fluorescent qualities, and use as follows:

Make a heavy bodied paint by working up some white lead, or better still—zinc white with Japan gold size. Use just enough turpentine so that the paint may be handled well with a brush. (The paint can be tinted with vermilion, chrome yellow, chrome green, orange or almost any color). Next paint the article or design with this; within 2 or 3 hours the paint will become sticky—not dry. Now sprinkle a thin layer of your powdered fluorescent mineral over the painted surfaces. The powdered mineral is best put on with a small strainer or

a sieve. Cover well but brush off the surplus. Set the article or articles aside to dry 24 to 48 hours. (Only one color at a time can be put on).

Do not put the mineral dust on too soon as it will settle into and mix with the paint. Fair results can be had with glue by the addition of white lead, zinc, or whiting. It is harder to work—not so good—not so durable.

Interesting designs can be made—a star for instance—by painting six cardboards, each with a different fluorescing mineral. Cut out the center of the star from one cardboard, and a ray from each of the others and then mount all together on a clean board.

It is important to note that most minerals lose their intense fluorescence when ground; the finer they are ground the duller they get.

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Mr. Varni has been associated with

the Maiden Lane gem district for over a quarter of a century; but feels that the time has come to move uptown where it will be more convenient for the firm's many friends to visit its offices.

SOME OBSERVATIONS ON FLUORESCENCE AND PHOSPHORESCENCE

By PETER ZODAC
Editor ROCKS and MINERALS

In the examination of minerals under the cold-quartz lamp, a number of tests were made to see how some of them would react. Various transparent substances were used, for example, to pass ultra violet light through. These substances were all larger than the specimens tested and were generally held close to the lamp. The following results were noted on specimens tested:

Minerals would neither fluoresce nor phosphoresce if the light was passed through glass, muscovite, or phlogopite.

Minerals would not fluoresce if light was passed through tissue paper but would phosphoresce.

Minerals would both fluoresce and phosphoresce if light was passed through colorless selenite, rock crystal, halite, or fluorite.

Immersing minerals completely in water, did not affect them in any way; they fluoresced and phosphoresced without trouble or variation though phosphorescence seemed to be of much shorter duration.

Heating the minerals did not affect them either.

One night three specimens were tested to determine how long they would phosphoresce. Each mineral was exposed to ultra violet light for one full minute (the lamp was laid on top of each) and then each mineral was taken to a dark room for observation. The minerals and time of exposure was as follows:

Wollastonite, granular, white, Riverside Co., Calif., 8:38 P. M. - 10:18 P. M.

Calcite, coarse xline, pinkish, Brewster Co., Texas, 8:39 P. M. - 10:25 P. M.

Kunzite, cleavable, pinkish, Mt. Apatite, Auburn, Me., 8:40 P. M. - 10:14 P. M.

At 10:05 P. M., all phosphorescing: calcite fairly bright, wollastonite, very weak, kunzite just about discernible.

At 10:14 P. M., calcite, very weak; wollastonite just about discernible; kunzite out.

At 10:18 P. M., calcite just about discernible; wollastonite out.

At 10:25 P. M., calcite out.

Thus calcite phosphoresced 1 hr. 46

min.; wollastonite 1 hr. 40 min.; and kunzite 1 hr. 34 min.

Hyalite from Little Switzerland, N. C., fluoresced at least 25 feet away from the lamp (limit of the total length of two rooms). Calcite from Brewster Co., Texas, phosphoresced 15 feet away from the lamp.

Mr. Emmet Doherty, of Peekskill, called the writer's attention to the fact that the ultra violet rays from a cold-quartz lamp will pass through a beam of light and fluoresce minerals 8 feet away. He also discovered that wernerite from Quebec, Canada, and willemite from Franklin, N. J., fluoresce slightly in the dusk—just after the sun goes down.

It was discovered quite accidentally, that many minerals phosphoresced beautifully if the lamp was actually laid on top of them, for about 30 seconds; holding the lamp 2 or 3 inches away was no good, often no phosphorescence was noted.

It was soon noted that many minerals containing iron as an impurity turned green to olive green under the cold-quartz lamp. Among minerals so doing were brown beryl, brown jasper, brown garnet, ferruginous quartz, brown opal, limonite stains, in fact all minerals stained yellow to brown by limonite and which were tested always turned green.

Fluorescence often played pranks which at times were not very pleasing ones. It was alright for dull, unattractive minerals to change into dazzling specimens of great brilliance but when the reverse happened, it was a keen disappointment. Brilliant green malachite, gorgeous pink rhodonite, or salmon calcite, and the lovely bluish-green chalcantite would turn into such dull, dreary, dirty-gray specimens one could hardly believe them to be minerals. At times the colors of fluorescence and phosphorescence were such odd ones that it was difficult to name them correctly. Furthermore some minerals showed no distinctive color change in fluorescing; their colors simply became deeper or more pronounced.

Luminescent Reactions Under the Cold-Quartz Lamp

Mineral	Locality	Fluorescence	Phosphorescence
Agate	Panama Canal	Green	
Agate	Minas Geraes, Brazil	Grass-green	Whitish
Agate	Goldfield, Nev.	Yellow-green	
Albite, white	St. Gothard, Switzerland		Pale golden brown
Albite, white	Branchville, Conn.		Pale golden brown
Albite, white	Amelia Court House, Va.		Pale golden brown
Albite (stained)	Bedford, N. Y.		Golden brown
Albite, gray	Peckskill, N. Y.		Pale golden brown
Albite, Cleavelandite	Portland, Conn.		Pale golden brown
Albite, Cleavelandite	Newry, Maine		Pale orange
Alunite, pinkish	Marysville, Utah	Grayish	
Alvite, brownish	Helle, Norway		Reddish-orange
Amazonstone, deep green	Amalia Court House, Va.	Pale grayish-green	
Amazonstone, deep green	Valhalla, N. Y.	Pale grayish-green	
Amber, yellow	Baltic Sea, East Prussia	Yellow green	
Amblygonite, white	Near Keystone, S. D.		Light-blue
Amethyst, purple	Lincoln Co., N. C.	Deep blue	
Amethyst, purple	Madagascar	Deep blue	
Apatite, dark brown	Renfrew Co., Ont., Canada	Dark green	
Apatite, dark green	Lake Baikal, Siberia	Gray, also blue	
Aquamarine, bluish-green	Mir Geraes, Brazil	Pale Green	
Aragonite, white	Alston Moor, Eng. and		Bright greenish-blue
Aragonite, gray coating	Peckskill, N. Y.		Pale bluish
Aragonite, gray coating	Tilly Foster, N. Y.		Bright blue
Aragonite, white	Bilboa, Spain		Pale bluish
Aragonite, brownish	Livermore, Calif.		Greenish-white
Aragonite, white	Death Valley, Calif.	Light green	Light blue
Aragonite, white	Allentown, Penn.	Pale green	Light blue
Aragonite, white	Mures, Rumania	Pale green	Light blue
Autunite, yellowish	Newry, Maine	Bright green	
Autunite, yellowish	Bedford, N. Y.	Bright green	
Aurichalcite, bluish-green	Magdalena, N. Mex.	Gray	
Aurichalcite, bluish-green	Vladivostok, Siberia	Gray	
Azurite, blue	Bisbee, Ariz.	Purple-blue	
Barite, white	Duften, Cumberland, Eng.		Pale bluish green
Barite, colorless	Freyington Iron Mines,		Pale bluish green
Bauxite, brownish	Nadine, Ga.		Whitish
Benitoite	San Benito Co., Calif.	Purple	
Beryl, bluish-green	Acworth, N. H.	Milky	
Beryl, brown	Bedford, N. Y.	Deep green	
Beryl, green	Bedford, N. Y.	Light green	
Beryl, green	Merrill, Conn.	Light green	
Beryl, golden	Minas Geraes, Brazil	Green	
Brucite, white	Hoboken, N. J.		Bluish
Brucite, white	Texas, Penn.		Light blue
Byssolite, gray-green	French Creek, Penn.	Gray	
Calcite, brown	Granby, Mo.	Green	
Calcite, brown	Silica, Ohio	Green	
Calcite, brown conglomerate	Linwood, Ohio	Pale green	
Calcite, colorless	Cumberland, England		Deep blue in pin points
Calcite, colorless	Cumberland, England		Yellowish-white
Calcite, golden	Picher, Okla.		Flashes of red
Calcite, gray	Franklin, N. J.	Deep green	Light blue
Calcite, gray	Edwards, N. Y.	Rose-red	Flashes of red
Calcite, gray	Langban, Sweden	Pinkish-red	Light blue
Calcite, metalcoated	Franklin, N. J.	Deep pink	Flashes of red
Calcite, pink	Brewster Co., Texas	Pale lavender	Blue
Calcite, salmon	Bear Mt. Park, N. Y.	Cream	
Calcite, salmon	Renfrew Co., Ont., Can.	Grayish-green	
Calcite, white	Bagdad, Arizona		Deep blue
Calcite, white	Near Bloomington, Ind.		Light blue
Calcite, white	Verplanck's Point, N. Y.		Light blue
Calcite, white	Washakie Co., Wyo.	Green	
Calcite, yellow (pale)	Prospect Park, N. J.		Light blue
Calcite, yellow	Lake Mine, Orange Co. N.Y.		Pale orange
Calcite, yellow	Verplanck's Point, N. Y.	Green	Bluish
Calcite, yellow (pale)	Pittsburgh, Penn.	Pale green	Greenish-white
Calcite, Dogtooth Spar	Robson, Penn.		Greenish
Calcite Sand xls	Pine Ridge Ind. Res., S.D.		Bluish-white

Mineral	Locality	Fluorescence	Phosphorescence
Calcium-larsenite	Franklin, N. J.	Bright yellow-green	
Carnotite, yellow	Montrose Co., Colo.	Bright yellow-green	
Carnotite, yellow	Mauch Chunk, Penn.	Bright yellow-green	
Celestite, bluish gray	Clay Center, Ohio		Pale bluish on edges
Celestite, bluish gray	Gembeck, Germany		Bluish
Cerussite, colorless	Linden Mine, Wisconsin	Olive green	
Cerussite, pale green	Phoenixville, Pa.	Bright green	
Chalcantite, blue	Butte, Mont.	Dirty gray	
Chalcedony, gray	Aguila, Ariz.	Blue-green	
Chalcedony, gray	Tampa Bay, Fla.	Green	
Chalcedony, brown	Brown Co., Ind.	Olive-green	
Chalcedony, brown	Oberstein, Germany	Deep green	
Chlorite, deep green	Zoar, Mass.	Grayish-black	
Chrysoberyl, pale green	Haddam, Conn.	Yellow green	
Chrysocola, bluish-green	Gila Co., Ariz.	Dull blue	
Chrysoprase, blue	Gila Co., Ariz.	Gray	
Cinnabar, red	Terlingua, Tex.	Slaty-brown	
Citrine, golden brown	Minas Geraes, Brazil	Deep green	
Colemanite, grayish	Calico Hills, Calif.		Pale blue
Concretions (Sand) gray	Near Signal Mt., Calif.		Greenish-blue
Copalite, brown	Zanzibar	Green	
Creedite, gray	near Wag'n Wh'l Gap, Col.		Blue
Crocoite, scarlet	Dundas, Tasmania	Dark brown	
Crocoite, scarlet	Beresovsk, Ural Mts.	Dark brown	
Deweyite, brown	Chester Co., Penn.		Light blue
Dolomite, brown	Alston Moor, Eng.	Yellow-green	
Dolomite, pink	Near Bloomington, Ind.	Pale grayish-green	
Emerald, deep green	Muzo, Colombia	Yellow-green	
Emerald, deep green	Minas Geraes, Brazil	Pale green	
Emerald, deep green	Emerald Mines, Ural Mts.	Pale green	
Ferruginous Quartz, brown	Canaan, Conn.	Deep green	
Ferruginous Quartz, brown	Otis, Mass.	Yellow green	
Fluorite, blue	Alston Moor, England	Blue	
Fluorite, blue	Rosiclare, Illinois		White
Fluorite, brown	Clay Center, Ohio		Yellowish-white
Fluorite, brown (golden)	Carrock Fell, England	Olive-green	
Fluorite, colorless	Yuma Co., Arizona		Deep blue
Fluorite, colorless	Branchville, Conn.		Pale white
Fluorite, colorless	Trumbull, Conn.		Bluish-green
Fluorite, colorless	Alston Moor, England		Whitish-blue
Fluorite, green	Westmoreland, N. H.		Deep blue
Fluorite, white	Carrock Fell, England		Light blue
Fuchsite, green	Cuttingsville, Vt.	Dull gray	
Garnet, Essonite, brown	Redding, Conn.	Dark green	
" Almandite, dark red	Gore Mt., N. Y.	Olive green	
Garnierite, green	Near Rooiberg, Transvaal	Grayish white	
Glauberite, gray	Borax Lake, Calif.		Bluish-gray
Granite, golden	Near Peekskill, N. Y.	Green (brown spots)	
Granite, gray	Near Peekskill, N. Y.		Pale yellowish
Granite, red	Sweden	Dull gray	
Gummite, orange	Bedford, N. Y.	Light green	
Gummite, orange	Yancy Co., N. C.	Light green	
Gypsum, brown	Grand Rapids, Mich.	Deep green	
Gypsum, pink	Grand Rapids, Mich.	Grayish	
Gypsum, white	Gypsum, Ohio		Greenish-blue
Gypsum, white	Gypsum, Ohio		Greenish-blue
Gypsum, white	North Holston, Va.	Light green	Greenish-yellow
Gypsum, Alabaster (white)	Pomaia, Italy		Bluish
Halite, colorless	No locality		Faint green
Halloysite, white	Near Bedford, Ind.		Light blue
Hanksite, grayish	Searles Lake, Calif.		Light blue
Hydrodolomite	Monte Somma, Italy		Pale bluish
Hydromagnesite	Lodi, N. J.		Light blue
Jasper, brown	Ichig Co., Penn.	Dark green	
Jasper, brown	Sicily	Green	
Jasper, conglomerate	Near Buffalo Gap, S. D.	Olive green	
Jasper, wood	Near Holbrook, Ariz.	Part green	
Ktypeite	Carlsbad, Bohemia		Pale bluish

Mineral	Locality	Fluorescence	Phosphorescence
Lapis Lazuli, blue	Andes of Ovalle, Chile	Purple	Brownish (white spots)
Lepidolite, cream	Near Keystone, S. D.	Pale green	
Limestone, white	Ausable Forks, N. Y.		Greenish-blue and golden brown
Limestone, brown	Verplanck's Point, N. Y.	Olive-green	
Limonite, brownish stains	Many localities	Green	
Magnesite, white	Muntodi, Greece		Faint bluish-white
Malachite, green	Katanga Dist., Belg. Congo	Dirty-grayish	
Microcline, flesh-color	Bedford, N. Y.		Pale golden brown
Monazite, brown	Raade, Norway		Reddish-orange
Norbergite, brown	Franklin, N. J.	Olive green	
Obsidian, brown	Stauffer, Ore.	Dark green	
Onyx marble, greenish	Ash Fork, Ariz.	Yellow-green	Pale greenish
Onyx marble, brownish	Morocco	Yellow-green	Greenish-blue
Opal, Boulder, vari-colored	Queensland	Purple	Whitish
Opal, common, brown	Goldfield, Nev.	Green	
Opal, Hyalite, bluish	Badad, Ariz.	Bright green	
Opal, Hyalite, greenish	Bedford, N. Y.	Bright green	
Opal, Hyalite, colorless	Bedford, N. Y.	Bright green	
Opal, Hyalite, colorless	Bedford, N. Y.		Greenish-blue
Opal, Hyalite, white	Peckskill, N. Y.	Bright green	
Opal, semi-Opal, brown	Little Switzerland, N. C.	Bright green	Light blue
Opal, semi-Opal, brown	Big Fork, Mont.	Deep green	
Opal, Wood Opal, brown	Virgin Valley, Nev.	Green	
Opal, Wood Opal, brown	Near Cambridge, Idaho	Green	
Opal, Wood Opal, brown	Near Huntsville, Texas	Olive green	
Orangite, reddish	Arendal, Norway	Dark green	
Orpiment, yellow	Manhattan, Nev.	Green	
Orpiment, yellow	Asia Minor	Yellow-green	
Orpiment, brownish	Tajowa, Hungary	Pale green	
Pectolite, white	Paterson, N. J.		Golden yellow
Pectolite, white	Bergen Hill, Snake Hill, N.J.		Golden yellow
Petrified Wood, brown	Bluffdale, Texas	Green	
Phosgenite, colorless	Monte Ponì, Sardinia		Pale brown
Phosgenite, yellowish	Monte Ponì, Sardinia		Reddish
Pitchstone, green	Goldfield, Nev.	Olive green	
Pitchstone, red	Goldfield, Nev.	Olive brown	
Polyadelphite, brown	Franklin, N. J.	Dark green	
Realgar, red	Manhattan, Nev.	Rusty brown	
Rhodochrosite, pink	Ouray, Colo.	Brownish	
Rhodochrosite, pink	Near Butte, Mont.	Gray	
Rhodolite, red	Franklin, N. C.	Lavender	
Rhodonite, pink	Plainfield, Mass.	Gray	
Rose Quartz	Bedford, N. Y.	Pale purple	
Rose Quartz	Custer, S. D.	Pale purple	
Rubellite, pink	Newry, Maine	Lavender	
Rubellite, pink	Pala, Calif.	Lavender	
Ruby, red	Franklin, N. C.	Purple	
Ruby, red	Franklin, N. C.	Green	
Satin Spar, Gypsum, white	Burntfork, Wyo.	Green (parts)	Whitish
Satin Spar, Gypsum, white	Burntfork, Wyo.		Pale bluish-green
Satin Spar, Gypsum, white	Bridgeford, England		Pale bluish-green
Scheelite, white	Silverton, Colo.	Bluish	
Scheelite, white	Big Wash, Utah	Bluish	
Scheelite, yellowish	Cochise Co., Ariz.	Bluish	
Scheelite, yellowish	Irish Creek, Va.	Bluish	
Scheelite, yellowish	Scheelite, Nova Scotia	Bluish	
Scheelite, yellowish	Komagalake, Japan	Bluish	
Selenite, colorless	Morrison, Colo.		Greenish-blue
Selenite, colorless	Fort Dodge, Iowa		Light blue
Selenite, colorless	Hudson, N. Y.		also golden yellow
Selenite, colorless	Ellsworth, Ohio		Light blue
Serpentine, precious	Peekskill, N. Y.	Yellow-green	
Siderite, brown	Ivigut, Greenland	Olive green	
Sphalerite, tribo (brown)	Beaver Co., Utah		Yellowish
Sphalerite, brown	Mexico	Dark green	
Spodumene, Kunzite, pink	Mt. Apatite, Maine		Flame red
Spodumene, Kunzite, pink	Newry, Maine		Flame red
Spodumene, Kunzite, pink	Portland, Conn.		Flame red

Mineral	Locality	Fluorescence	Phosphorescence
Stalactite, white	Mammoth Cave, Ky.	Light green	Greenish-blue
Stalactite, white	Allentown, Pa.	Green	
Stalactite, white	Cumberland, England		Greenish-blue
Stalactite, colorless	Owyhee Co., Idaho		Light blue
Stilbite, brown	Moore Station, N. J.	Light green	
Srortianite, brown	San Joaquin Valley, Calif.	Olive green	
Srortianite, white	Alston Moor, England		Greenish
Srortianite, white	Hamm, Westphalia, Germ'y		Bluish white
Sunstone, reddish	Tvedstrand, Norway	Brownish	
Talc, greenish	Harford Co., Md.	Gray to yellowish	
Thaumasite, white	Paterson, N. J.		Greenish-blue
Tiger Eye, brown	Transvaal	Green	
Topaz, brown	Minas Geraes, Brazil	Olive green	
Topaz, pale yellow	Schneckenstein, Germany	Light green	
Tremolite, white	Jefferson Co., N. Y.		Bright red
Tremolite, white	St. Lawrence Co., N. Y.		Faint red
Tripoli, brown	Seneca, Mo.	Gray	
Trona, white	Near Keeler, Calif.		Pale blue
Turquoise, blue	Dona Ana Co., N. Mex.	Chalky white	
Ulexite, white	Windsor, Nova Scotia		Greenish-blue
Uranophane, yellow	Bedford, N. Y.	Light green	
Uranophane, yellow	Yancy Co., N. C.	Light green	
Vanadinite, red	Old Yuma Mine, Ariz.	Deep green	
Wavellite, white	Mt. Holly, Penn.	Blue (parts)	Light blue
Wernerite, lilac	Bolton, Mass.		Deep red
Wernerite, gray	Renfrew Co., Ont., Can.		Pale red
Willemite, green	Franklin, N. J.	Bright green	Light green
Witherite, gray	Hexham, England	Green	Bluish-white
Witherite, gray	Nentsbury, England		Blue-green
Wollastonite, white	Riverside Co., Calif.		Golden yellow
Wollastonite, white	Neshaminy, Penn.		Golden yellow
Wollastonite, white	Copper Mountain, Alaska		Golden yellow
Wulfenite, yellow	Yuma Mine, Ariz.	Green	
Wulfenite, brownish	Organ Mts., N. Mex.	Green	
Zircon, brown	Henderson Co., N. C.	Orange-brown	

FOURTH NATIONAL OUTING OF THE ROCKS and MINERALS ASSOCIATION

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Sunday, May 24, 1936

Each year, for the past three years, Rocks and Minerals Association has sponsored a National Outing. The individual field trips comprising this event have always been most successful. The large number of persons attending has especially been gratifying. Unfortunately it was not possible for all members to participate due to the fact that most of them resided at some distance from the locality where an outing was being held in their respective state. To overcome this difficulty, this year we will depart somewhat from the usual procedure. Instead of having group outings under directors, we shall have individual outings. No matter where you may live, be it in a large city or in a small community, somewhere around you is a mine, quar-

ry, gravel pit, rock outcrop, river or lake beach, or some other type of mineral locally. On the day set aside for the Outing, visit one of these occurrences, even if you have to go alone. We would suggest that two or three days prior to the Outing a brief item be inserted in your local newspapers relative to the event. The item should state the aims of the Outing; the mineral locality you plan to visit; and should invite readers to accompany you. **After the Outing is over, that very night if possible, write us a few words telling where you went, how many were in the party and what was the principal mineral collected (a post card will do.)** Address your cards to F. W. Schmeltz, Director of Outings, Rocks and Minerals, Peekskill, N. Y.

The aims of these annual outings are:

(1) To provide the uninitiated an opportunity to enter the fascinating hobby of mineral collecting; (2) provide a meeting place for collectors to become acquainted with one another; (3) acquaint the public with the mineral resources of their respective states; (4) and generally to stimulate and encourage an interest in the study of mineralogy.

We are pleased to print extracts from a letter from one of our young members, Douglas Graham of Takoma Park, Md., relative to the Outing: "In regard to the National Rocks and Minerals Day, let me say that now, then or at any time it will be a pleasure to cooperate with you by visiting some quarry and sending you a report on who went, where, and what we found. I believe it will be a simple matter to shanghai at least four of my friends for the day without using too much violence in persuading them to come along."

In addition to the individual outings, two group outings will also be held the same day as follows.

Massachusetts

Director:—John Kitson, 30 Briggs Street, Easthampton.

Assist. Directors:—Prof. Benjamin Shaub, Anthony Kendrew, Raymond Schortman, Alvin Schortman, Walter Connor.

Locality:—Chester, Mass., Emery Mine.

Schedule:—1:00 P. M., Registration at mine. 1:30 P. M., Address by Prof. Benjamin Shaub. 2:00 P. M., Collecting begins. Everybody welcome.

New York

Director:—Peter Zodac, Editor ROCKS AND MINERALS, Peekskill, N. Y.

Locality:—Paterson, N. J., trap rock quarries.

Meeting Place:—11:00 A. M. at New Street Quarry, Paterson. The main street into Paterson from New York City is Broadway; in the heart of Paterson turn left on Market Street, left on Main Street, right on Grand Street, and left on New Street. The quarry is on the right about 600 feet from the overhead railroad bridge (Paterson Crushed Stone Co. operate the quarry).

Note:—This is one of the world's most famous localities for fine minerals. The quarry is closed to the public and of course to collectors, and because of the difficulty in securing permission to enter the workings, ROCKS and MINERALS has deemed it necessary to limit the group to members of the Rocks and Minerals Association only. Therefore it will be necessary for members to present their membership cards before they will be allowed to collect. To avoid any delays or disappointments, send in for your membership card to day (enclosing a self-addressed stamped envelope for it). All subscribers to ROCKS and MINERALS are members of the Rocks and Minerals Association. **Neither the Association nor the owners of the quarry will be responsible for any accidents incurred by those participating.**

FRED W. SCHMELTZ,
Director of Outings.

SOME NOTES ON FLUORESCENCE

By L. J. HAUSER

It was with much interest that I read the April issue of ROCKS and MINERALS as I am particularly interested in fluorescence. For many years I have been trying to find suitable products for use in the manufacture of fluorescent paint. I have read almost everything in the English language that was printed during the past 50 years and some even earlier, as well as a number of foreign notes. I have kept notes and records of experiments until there is in my files 27 large note books of 200 pages each; over 4,000 file cards,

and boxes full of loose notes (unsorted), as well as a large number of books, magazines, pamphlets, etc. (all on fluorescence). I have traveled far and wide to see and examine fluorescent displays, exhibits and collections.

I have made so far about 25,000 combinations of fluorescent paints and have records of several thousands that gave some results. In general, the manufactured fluorescent paints surpass fluorescent minerals, with a very few exceptions. I have yet to see reds, oranges, yellows or purples in minerals

to compare with manufactured paints. A blue paint in my possession is brighter, more vivid and of more shades than can be seen in minerals—although some minerals do show very good blue fluorescence. I find green to be the most common color in fluorescent minerals—many are very good—a few about equal to the artificial products.

When working with fluorescent paints, the strange part of it is the ease with which fluorescence can be quenched in compounds. Some are very sensitive and may be quenched or greatly diminished by adding certain bases, salts or acids. Others are not effected when

these ingredients are added. I have seen paints turned out by many firms but believe mine are equal to the best—better than most; some of my colors have not as yet been equalled or even imitated.

I became interested in minerals because mineralogists know more and have tinkered with them more than any other group. I have furthermore interviewed and corresponded with a large number of people who have experimented with fluorescent minerals or paints but in summing up all their ideas and theories, I conclude no one knows—the how and why of it.

THE IMPORTANCE OF FLUORESCENCE AND PHOSPHORESCENCE .

By PETER ZODAC

Editor ROCKS and MINERALS

Aside from their spectacular change of light, fluorescence and phosphorescence have a number of important advantages that make their phenomena of special value to mineral collectors. Some of their advantages are:

1—They often make dull, unattractive minerals glow with beautiful colors.

2—They are often simple, decisive tests for identifying a number of minerals.

3—They often disclose the presence of a mineral not suspected to occur.

4—They are a source for much experimenting that may result in many new discoveries.

5—They may be the means of awakening an interest in minerals in the average individual who otherwise would give them no thought.

Many minerals are unattractive as specimens for a collection but if they fluoresce or phosphoresce they may glow beautifully under an ultra-violet light. Such minerals might become "prized" specimens in a collection. An example is a specimen of Grenville limestone from the Adirondack Mts. Mr. Fred G. Carnes, of the Carnes Granite Co., Ausable Forks, N. Y., sent a specimen to the writer as an example of the limestone which outcropped across the river from the quarry—never dreaming it was phosphorescent. By chance it was placed under the ultra violet rays of a cold-quartz lamp when its true nature was discovered

and now is a prized specimen. (See p. 75 in this issue).

A number of minerals as fluorite, hyalite, scheelite and willemite fluoresce so readily and with such a decided tinge or color that they are often easily determined by fluorescence alone.

In testing a group of minerals one night under ultra violet light, the rays happened to fall on some molybdenite-bearing granite from near Peekskill, N. Y., when suddenly a bright green fluorescence occurred. It was wholly unexpected. At first it was thought to be autunite but the bright green patches dispelled the idea. Next day the specimen was carefully examined but the fluorescent mineral could not be seen. That night the mineral was again placed under the ultra violet light and the fluorescent patches marked out in pencil. Next day the specimen was again minutely examined and the fluorescent mineral detected. It was hyalite in minutely thin colorless crusts on quartz. This was the first find of a fluorescent mineral around Peekskill.

Although fluorescence and phosphorescence have been known for many years, it was only recently that ultra violet lamps, for collectors, made their appearance. During the past few years, many improvements in lamps have been made, many fluorescent and phosphorescent minerals discovered and many ideas propounded. The phenomena is still in its infancy nevertheless

fluorescence for example is being widely used in the arts, sciences, and commercially. Just what the future may bring can only be conjectured but the future looks very promising and prospects for important commercial, medical, scientific and other discoveries are in the offing. Here is an excellent field for the mineralogist.

To many people an ordinary mineral collection has no appeal. Even beautiful crystals or rare minerals fail to create a spark of interest. But show such people some fluorescing minerals and they are all attention. Two years ago at the Hobby Show held in Rockefeller Center, New York

City (conducted by Hobbies Magazine of Chicago) many fine mineral specimens, ores, crystals and cut gems were on exhibition. Though thousands of people passed by the booths daily, few stopped to examine the specimens and of course few sales were made. But one booth, that of Stephen Varni Co., was not passed. This enterprising firm had installed a fluorescent exhibit and the crowd that gathered around their booth and remained, all day, was amazing. Many fluorescent minerals were sold and many mineral collections thus started. The Varni Co. was the only exhibitor, known to us, who made out good at the Show.

SOME INTERESTING PHOSPHORESCENT MINERALS

By PETER ZODAC

Editor ROCKS and MINERALS

In the course of examination of a large assortment of minerals under the cold-quartz lamp, a number were found which phosphoresced so nicely as to be worthy of special attention. To the writer's knowledge, these have not as yet been described so that a few notes may prove of interest to our readers.

Fluorite, Yuma County, Ariz. A gemmy, almost colorless little specimen is in the writer's collection and it phosphoresces the deepest blue of any mineral ever seen. It is about 3-4 inch long and 1-4 inch wide and only a tip at that phosphoresces, but it glows a beautiful deep blue when the lamp is shut off. For about one minute this beautiful blue glow is given off and then the whole specimen becomes bluish-white and phosphoresces for at least 20 minutes. A large thick cleavage sheet of colorless selenite was laid over the fluorite and both subjected to the cold-quartz lamp. The selenite phosphoresced a pale greenish-blue and the tiny fluorite its deep blue which showed up clearly through the selenite. Exposing the fluorite to the ordinary electric light, it phosphoresces deep blue as before.

Fluorite, Alston Moor, Cumberland, England. An almost colorless crystal, when exposed to the cold-quartz lamp, phosphoresces a brilliant whitish-blue which seems to increase in depth if rubbed with the fingers. After exposure

to the lamp and then set aside where it soon apparently dies out, if the crystal be rubbed with the fingers or better still rubbed briskly on the coat sleeve, it assumes its brilliant phosphorescence as before. Exposing this crystal to the ordinary electric light, it phosphoresces easily.

Kunzite, Mt. Apatite, Auburn, Maine. A cleavable, pinkish variety of spodumene, phosphoresces a deep reddish-orange and for so long a period that it was taken as one of three specimens for ascertaining the duration of phosphorescence. In the test, the kunzite was the first to cease, its duration lasting 1 hour, 34 minutes. (See "Some Observations on Fluorescence and Phosphorescence" in this issue).

Limestone, Ausable Forks, N. Y. A small specimen of Grenville limestone was sent the writer by Mr. Fred G. Carnes of the Carnes Granite Co., Ausable Forks, N. Y. Mr. Carnes, a valued subscriber of *ROCKS and MINERALS*, had inserted the specimen with an assortment of polished minerals from his quarry which he donated to the Editor. The specimen is an impure limestone, white in color, with many grains of smoky quartz and graphite flakes and is representative of the Grenville limestone which outcrops across the river from the quarry. Under the cold-quartz lamp, the specimen phosphoresces beautifully in two

colors—greenish-blue on top (as if in the form of a crust) while the main mass is golden brown. The greenish-blue color soon fades; the brown shines through, appears to increase in volume and then it too dies out.

Tremolite, Jefferson Co., N. Y. A small specimen of grayish schistose tremolite (amphibole) phosphoresces a deep red under the cold-quartz lamp.

It is so sensitive to friction that a finger nail will make sparks (best seen in the dark). This type of tremolite is known as "electric stone."

Wollastonite, Copper Mountain, Sulzer, Alaska. This mineral occurs in large, grayish-white, radiating clusters of crystals. It phosphoresces a beautiful golden-yellow, of long duration.

AUTUNITE IN MITCHELL COUNTY NORTH CAROLINA . . .

By BRADLEY JOHNSON

Autunite is usually considered a secondary mineral, derived from the alteration of some of the other uranium minerals, and is described chemically as being a hydrous uranium-calcium phosphate. While autunite contains a fairly high percentage of uranium, it is too rare to create any commercial interest, and its usefulness is confined almost exclusively to fluorescent purposes. In its most prevalent form, as crystalline scales on various rocks, it does not hold any great interest as a hand specimen for the collector; but put the same specimen under the ultra violet lamp and its beautiful yellowish-green fluorescence is enough to please the most exacting.

The writer has no desire to convey the impression that all North Carolina autunite originates in Mitchell County. Many good specimens have been found at various points along the pegmatite belt, which crosses the State, and it is possible that it would be abundant at some of these localities. It would be impractical to describe all these finds in a brief article, and unfair, because no thorough investigation has been made of the entire pegmatite belt. This article is, therefore, confined to the greater part of all specimens now residing in collections, and in the dealers' bins.

The autunite at all the described localities occurs as small crystalline scales, or flakes, resembling bits of mica, but very brittle. These scales seem to prefer feldspar to any other rock and most good specimens are found in the purest feldspars. These autunite scales range in color from pale yellow to lemon-yellow, and yellowish-green; and under the argon

lamp they show a very intense yellowish-green fluorescence.

Smith Mine

The Smith Mine is mentioned first because its easy accessibility interests the average collector who does not have plenty of time. This mine is located about one mile from the railroad station at Spruce Pine, on the Bakersville highway. It is on the hillside just above the highway, and a car can be driven up a gravel road to the dump.

The Smith has not produced a great quantity of specimens, but most of them have been good. The autunite scales here are usually very small but are evenly distributed over the feldspar, thus making good fluorescent specimens. An occasional specimen of bluish apatite may be found carrying the autunite. This mine also produces occasional specimens of uraninite, gummite, and uranophane. The dump is the best place to search, and will yield something that will interest most collectors.

Cloudland Mine

The Cloudland is located on Pizzle Mountain, in the Cane Creek section of Mitchell County; and about 4 miles N. E. of Bakersville, the county seat. It would be advisable for the stranger who intends to visit this mine to take a guide who is familiar with the roads and trails, as it is necessary to drive over some rough mountain roads, and hike about one mile up the mountain.

This mine is well worth visiting, despite its isolation, and will surely reward the collector for his exertions. It is one of the first mica operations of the district and has a very interesting history, which can be heard from any of the old settlers.



While the Cloudland has not been operated, to any extent, for many years; the dump will still give specimens worthy of a place in any collection. Crystals of phlogopite mica may be found with the small scales of autunite clinging to the edges and, sometimes, on the cleavage face. Nice crystals of sea-green apatite in a matrix of white albite are rather plentiful, and occasionally both minerals will have a liberal sprinkling of autunite. Microscopic garnet crystals of a pale wine red color are intimately associated with the albite, and apatite, which adds to the beauty of some specimens. Oligoclase found at this mine is also very attractive.

The most interesting thing found at the Cloudland, however, is a yellowish and greenish colored hyalite which gives a very intense green color under the argon lamp. This material was first thought to be a crystallized form of autunite because the fluorescent properties were almost identical, and the visible color somewhat similar. A microscopic examination by Dr. Henderson, at the National Museum, disclosed the fact that some other mineral, possibly autunite, had been deposited in the hyalite. The deposited mineral was in very small quantities, but sufficient to account for the unusual colors. Specimens of this hyalite worn to a smooth surface by rough handling still give even, and intense, fluorescence. The same is true of the autunite, however; years of exposure in the dumps does not seem to have affected the fluorescent properties.

Deer Park No. 2 Mine

This is a mica and feldspar quarry, located about three-quarters of a mile S. E. of Penland, N. C.; and on the opposite side of North Toe River. It is possible to drive a car to this mine in dry weather, by crossing the river at Penland and heading up the opposite side.

Most of the autunite at this mine has been deposited in tiny seams, or cracks, in the microcline and albite feldspars. Many beautiful specimens from this mine have gone out to collectors all over the United States, and some to Canada. The scales of autunite are a little larger than the av-

erage and have excellent fluorescent properties, but they have a tendency to concentrate in one spot and diminish, in number, with the distance away from this spot. This is probably caused by the widening and narrowing of the seam in which they are deposited, and tends to make large specimens rather rare, and small specimens unusually good. Green scales of torbernite are sometimes associated with the autunite. Another peculiarity is that the autunite is rarely found on the blue quartz, while the torbernite scales are abundant. Large blocks of the muscovite mica are sometimes found with a liberal deposit of autunite along the edges, and scattered flakes across the face.

Deer Park Mine also produces some good specimens of garnetiferous mica, thulite, uraninite, gummite, and small crystals of monazite.

Cook Mine

The Cook Mine is located just across the river from the feldspar plant at Minpro, N. C., and is about 2 miles North of Spruce Pine. This mine is not in operation at the present time, but during the past two years it has produced many good specimens, and for that reason deserves some mention here.

All the autunite found at this mine was associated with microcline feldspar. The scales are somewhat smaller than those found at Deer Park Mine, but are evenly distributed over the entire specimen, and this makes an excellent showing under the argon bulb. This material has an added advantage in some specimens; the autunite seems to have penetrated into the hardest part of the rock and will expose a face carrying autunite anywhere you care to break it. Knowing this habit, if one should find a large specimen with a poor face, it is often possible to break it carefully and expose a good deposit of autunite. None of the other rare minerals have been observed at this mine.

The writer has never found any autunite that shows phosphorescence, which is not uncommon in hyalite, and on the other hand he has never found autunite that did not fluoresce to some degree.

THE AMATEUR LAPIDARY

Conducted by J. H. HOWARD*

504 Crescent Ave., Greenville, S. C.

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all.

*Author of—*The Working of Semi-Precious Stones, and Handbook for the Amateur Lapidary.*

THE ANCIENT LAPIDARY . . . By J. H. HOWARD

If we amateur lapidaries are threatened with illusions as to our skill or craftsmanship, it might do our souls good to wander back a few thousand years and spend a little time with some of our earlier brother workmen.

In this year A. D. 1936, if we (aged fifteen to fifty years,) decide we wish to cut and polish some particularly attractive stone the procedure is relatively simple. On a sheet of white paper we write with a steel pen and chemical ink, a request for information. We address the letter to a man a thousand miles away, place on it a three cent stamp, drop it in a box a few feet from our baked brick house and sit back on our haunches to await results. It has taken us five minutes to write the letter and the cost of material and transportation of the letter to its destination has cost us the labor of from one to three minutes. We have asked: "What material is required to cut this stone?—What will this material cost?—Where can I buy it?—How is it to be used?"

In about six days, more or less, we get the answers to all our questions. We are told to buy: An electric motor, some kind of spindle, carborundum wheels, carborundum grains, powdered pumice stone, tin oxide, metal laps, wood laps, felt laps and several minor items which have been already prepared for us by some one else. We rig up the machine as we are instructed, attach two copper wires, go to work, then spend our next few weeks "beefing" about how hard it is to get a fine polish.

Right here is where our souls need the cleansing action that will be afforded by the brief retrospect suggested in a former paragraph. Our ancient brother in grief did not have a single one of the above mentioned "necessities." The pumice stone is the only one of the items that he had at all and it of course was not powdered. There was no motor except his hand or foot. No spindle except such as he might make of wood and with wooden bearings and with no tools except a stone axe or chisel. Carborundum is synthetic and is quite new. There was no metal except such pieces of native copper as he might find and there were no tools to work it with except tools of stone. There was no "felt" though he might have substituted tanned skins for this item.

There was a fellow who had something to "beef" about! And he probably did it! He probably grunted and groaned and pulled his tangled beard "even as you and I" but he did the job and he did it remarkably well. To cite just a few specific examples:

Mr. Burnham S. Colburn, of Biltmore Forest, N. C., has in his gem collection a ruby bead found in a Cherokee Indian grave in Western North Carolina. There is no indication that this stone was worked by white men. On the contrary the workmanship is of such order that it is extremely unlikely that the cutting is European or Asiatic. While it is very irregular in shape it has been pierced for use as a pendant. The ruby is next to the diamond in hardness. A few diamonds

have been found in North Carolina and while it is possible that the workman who did this job had a diamond with which to do the drilling, the rarity of diamonds here makes the probability very remote. Corundum is quite common in this section so it is a fairly safe assumption that corundum was used. Those of us who have tried to cut a stone of a given hardness with abrasive of the same hardness can appreciate what he was up against.

Mr. William C. Orchard, of the Museum of the American Indian, has written a most interesting paper, "Obsidian Ear-Ornaments." This paper is contained in "Indian Notes," Vol. IV, No. 3, Museum of the American Indian, New York, N. Y. (July, 1927). Mr. Orchard has kindly given his permission to reproduce the drawings and to quote from the paper as follows:

"Fig. 1 illustrates an obsidian ear ornament, a description of which applies likewise to two others displayed in the Mexican exhibit of the Museum. As examples of craftsmanship, these specimens are unequalled among the many delicate objects produced by the ancient aboriginal artisans, a fact that can be the better appreciated when the nature of the material of which they are made is considered. Obsidian is very dense and brittle, hence a slight blow or pressure properly applied will result in a perfect flake.

"The methods ordinarily employed in the manufacture of stone objects consisted of flaking, chipping, pecking, grinding and polishing. Doubtless the first step employed in fashioning ear ornaments from obsidian was flaking, in order to roughly shape the block of raw material; then followed chipping, grinding and polishing. This conclusion is based on evidence afforded by comparison with two smaller obsidian objects in the collection, of the same shape as the ear ornaments, but which are in an unfinished condition. One of these especially shows chipping on the surfaces of the flanges, done to reduce the object to the desired thickness before grinding was commenced. Some of the chipping or flaking may have been done to reduce the diameter to the approximate size desired but the grinding has been carried so far that only traces of the flaking are left. The channel around the central column has been almost



Courtesy Museum of the American Indian

Fig. 1—Obsidian ear-ornament from Santiago de Tlatilco, Valley of Mexico. Actual Size.

completed by the grinding process, but the fact that one of the flanges is broken is probably the reason for its unfinished state. The ground surface indicates that the abrasive material employed may have been a bit of sandstone or loose grit borne by a piece of wood. The exact process of manufacture can only be surmised; but we know that stone objects were perforated with a drill rotated by means of a bow, the so-called pump-drill, or the shaft of the drill was revolved back and forth between the palms. These methods are illustrated in the ancient sculptures and in the native codices of Central America. There are numerous objects exhibiting partly drilled perforations made with a hollow drill, such as a reed, which carried grit as a cutting medium during the process. It may be therefore assumed, that the central columns of the obsidian ear ornaments were perforated with a drill, and in all probability with a hollow one. In both operations, grinding and drilling, water was used with the grit. The skill of the artisan is especially displayed by the exquisite finish imparted to the ear ornaments and by the incredibly even thickness of the walls of the columns and the flanges. The finishing operation removed every trace of abrasion due to grinding in the primary stages of manufacture.

"With regard to dimensions, the extreme diameter across the flanges is one and seven-sixteenths of an inch; the perforation is seven-eighths of an inch in diameter. From front to back, that is from end to end, the spool is five-eighths of an inch. The edges of the flanges are a thirty-second of an inch, expanding to a sixteenth of an

inch where they join the column; while the walls of the column, with very little variation, are a trifle more than a thirty-second of an inch thick. The color of the obsidian is greenish black. As demonstrated in our illustration Fig. I, the material is as transparent as a piece of smoked optical glass, for the rear flange is clearly shown through the walls of the central column.

"The manner of wearing such an ornament is shown in Fig. II. The lobe of the ear was pierced and the perforation enlarged gradually by the insertion of plugs of successively increasing sizes until it was large enough to accommodate the ornament. As such a method is employed by modern peoples who wear ornaments of this kind, there is no reason to believe that the ancients did not use similar means."

We are also indebted to Mr. Orchard for Fig. III* and the following note:

"Fig. III is an X-ray photograph showing the drilling of a jadeite ornament that came to us from Costa Rica. Of course we can only surmise how the drilling was done. I have an idea that a wooden shaft was used to

carry an abrasive of some kind. This specimen was made long before the coming of white men to this country. Copper implements are common in some regions but none have turned up in the area our jadeite ornament came from. I think the old Indian who made it must have spent a very long time making the perforation alone. The object is highly polished."

The above cases are typical of the work done by men of the stone age. The Museums have thousands of examples of intricate carving and perfect polishing done by men who had none of our modern mechanical aids and no materials except such as they could dig from the earth.

There is such a fruitful field here for some man with an interrogative and analytical mind. How was this work done? We may theorize and surmise but we will never know unless some one does it and duplicates the results gotten by the ancients using only the primitive means at their disposal.

A few years ago Mr. Halvor L. Skavlem became interested in the methods used by the Indians in making their arrow-heads and similar artifacts. He began investigating and experimenting when he was about seventy years old. The results of his work are published in a bulletin of the Logan Museum of Beloit College and are very illuminating. The "lost art" was found again. Mr. Skavlem found that with nothing but primitive tools he could duplicate any of the Indian chipped work and demonstrated the falsity of many of the theories and legends of the methods used by the Indians to obtain their remarkable results.

A similar investigation of the methods of cutting and polishing by abrasion would be a fascinating and valuable study.



Courtesy Museum of the American Indian
Fig. II.—Method of wearing an obsidian ear-ornament.

*Editor's Note:—Illustration could not be used as it was too long for the page. It represents a slender jadeite ornament. The X-ray photograph plainly shows it had been drilled from both ends—one drilling being twice the length of the other. Furthermore, the two drillings did not meet—end to end—but overlapped slightly. The longer drilling had deviated from the center and had it been continued might have pierced the side. The shorter drilling went in straight and true. It is only logical to believe that the longer drilling was started first and then the shorter bored to meet it.

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